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Federal Communications Commission
Office of the Secretary

Voice Over IP Overview: Services, Architectures, Ordering, and Billing

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An SAIC Company

VoIP Sea and Islands

VoIP Net

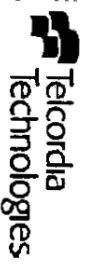
Island 1

VoIP Net

Island 2

IP

Continent

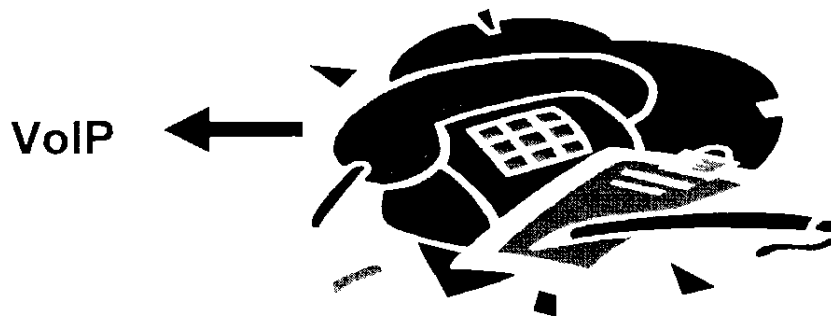


PSTN

Continent

Introduction

- **VoIP is here now and is growing rapidly.**
- **The regulatory issues are being addressed. The benefits from VoIP technology of efficient use of networks and new enabled services are much greater than the cost cutting via circumventing regulatory charges**
- **Retail VoIP service ordering and billing solutions for different VoIP architectures are being developed with different maturity.**
- **Interconnection and wholesale/resell business processes and data exchange among VoIP related service providers lack industry wide coordination.**
- **OBF can play an important role to connect existing and emerging VoIP islands cost-effectively in ordering and billing.**



Outline

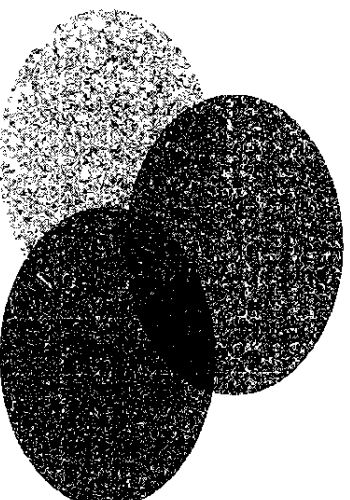
- **What and Why VoIP**
 - **VoIP Services**
 - **VoIP Market and Evolution**
 - **VoIP Technology Overview**
 - **State of VoIP Technology Adoption**
 - **VoIP End Point Connection Types**
 - **Key Differences of VoIP Ordering and Provisioning from Circuit Switch Voice Services**
 - **Key Differences of VoIP Billing from Circuit Switched Voice Services**
 - **Issues: Regulatory, Business, Standards**

What is Voice over IP (VoIP) ?

Voice over IP is the technology to transmit voice over IP networks and the associated services enabled by the technology

VoIP Services

Telephony Services



Other IP Voice Applications

Unified Communication Services

VoIP Services

- **Telephony Services**

- **POTS/Class/Voice Mail Services (Internet/IP Telephony)**

- PC to PC
 - PC to Phone
 - Phone to Phone
 - Phone Card (Pre-Paid or Post-Paid)

- **Centrex/PBX Services (IP Centrex/PBX)**

- **IN Services**

- Toll Free, Time-of-Day Routing, Voice VPN, Area Code Selection, Voice Dialing, SCP-enabled services,

- **Unified Communication Services**

- **Multimedia/Mixed Media Communication**

- Instant Messaging, On-demand Conferencing, Presence Management, Collaboration, Media Streaming, Unified Messaging, Caller Image/Info Delivery,

- **Web/Data/Voice Integration**

- Click to Talk from Web or E-Mail, Directory Dialing, ENUM (E.164+DN), Real-Time Feature Parameter Changes, Call Control and Logging, Automated Attendant,

- **IP Voice Applications**

- **Enterprise Applications**

- Distance Training/Learning, IP Contact Center, Voice Portal, Voice Enabled Transaction and Content Services, Voice Web Advertisement, Tele-medicine

- **Personal Applications**

- Multi-Modal Navigation/Map, Voice Enabled Information Services, Gaming with Voice and Data

Why VoIP

1. Cost Savings

- Efficient Use of Network Bandwidth for Voice and Other Traffic
- Enabling Customer Self Service to Cut Down CSR Costs
- Leveraging the Maturity of IP Technology, Competition of IP Equipment, and Broadband Internet Access
- Enabling Business Customers to Reduce Telecom Management Costs of Voice and Data
- Lowering the Toll Costs for Customers Thru IP Network

2. New Services

- New and High-Margin Telecom Service Revenues for Carriers
- Satisfying Customer's Needs for More Convenience and Unified Communications
- Enabling Disaster Recovery and Remote Operations for Business Customers

VoIP Service Market

1. IP telephony service providers handle about 1.12 B calls/month (1/2002); 6.8 B calls in 2001; \$1.7 B revenue from intl. calls - about 5% of total International minutes
2. Other VoIP services reach about \$25B in 2008, growing from < \$2B in 2003

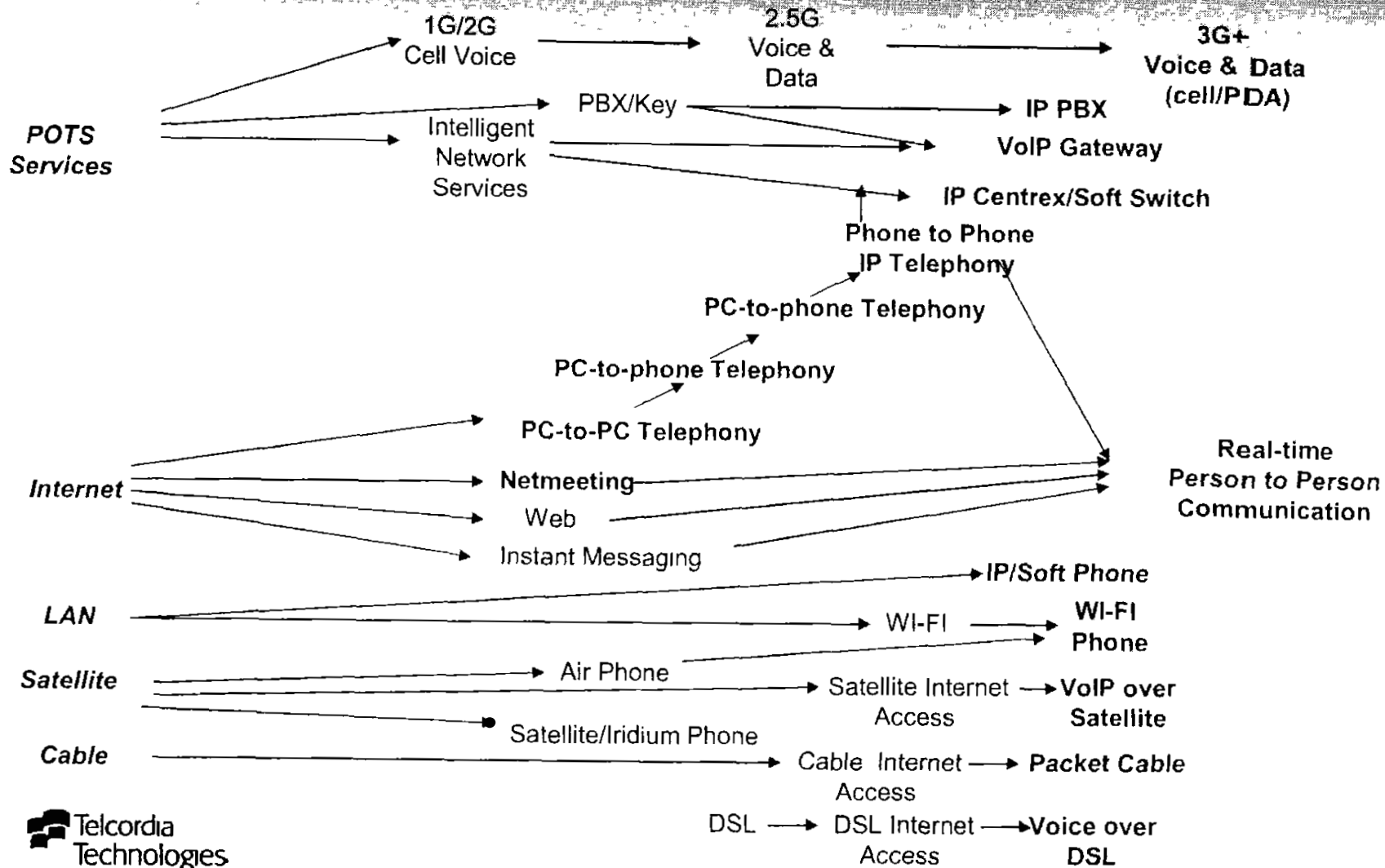
Sources

(1) iLOCUS, 2002

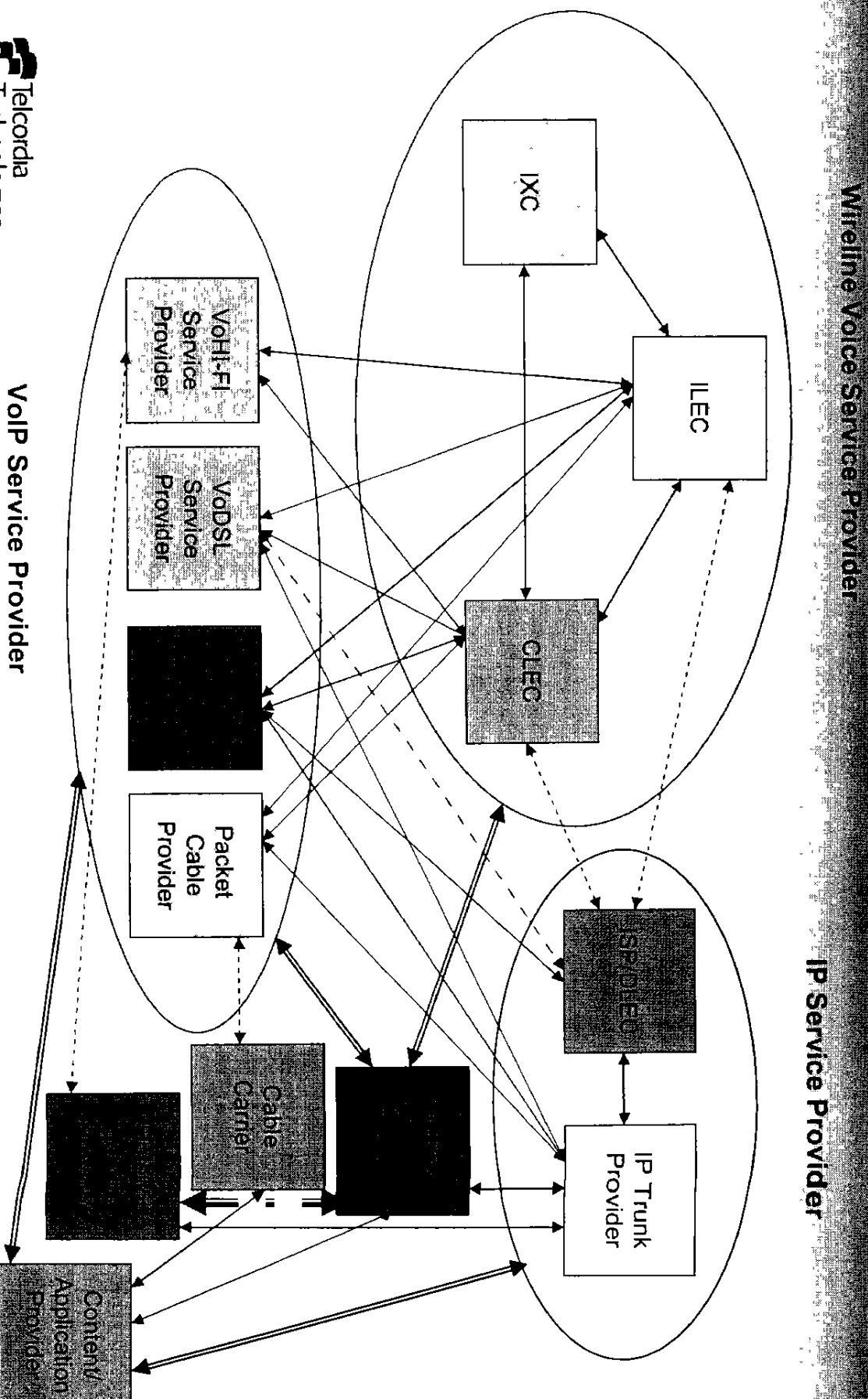
(2) Telcordia Technologies analysis from industry sources IDC, Frost and Sullivan, Yankee Group, EletronCast, CyberEdge Information Systems

(3) IDC, U S Contact Center Consulting and Implementation Service Forecast and Analysis, 2002-2006, April 2002

Voice over IP Evolution - End User View



Business Relationships Among Carrier Types – Ordering and Billing



VoIP Technology Overview

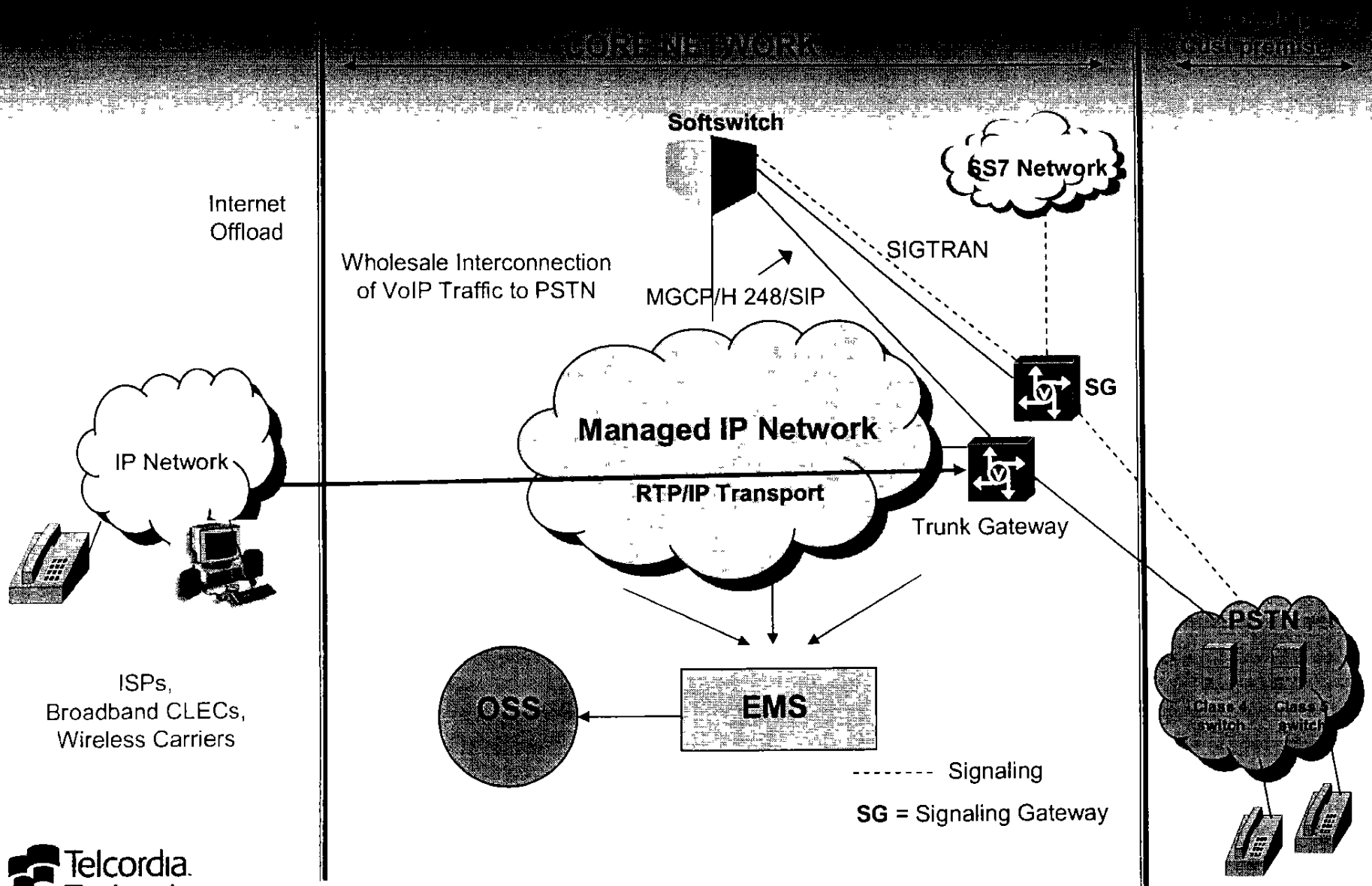
- **VoIP Architectures**

- Class 4 Internet Telephony Gateway
- Class 4 Packet Tandem
- H.323 Gateway/Gatekeeper
- SIP Server
- Class 5 Soft Switch*
- IP-Centrex with Circuit Switch
- Packet Cable

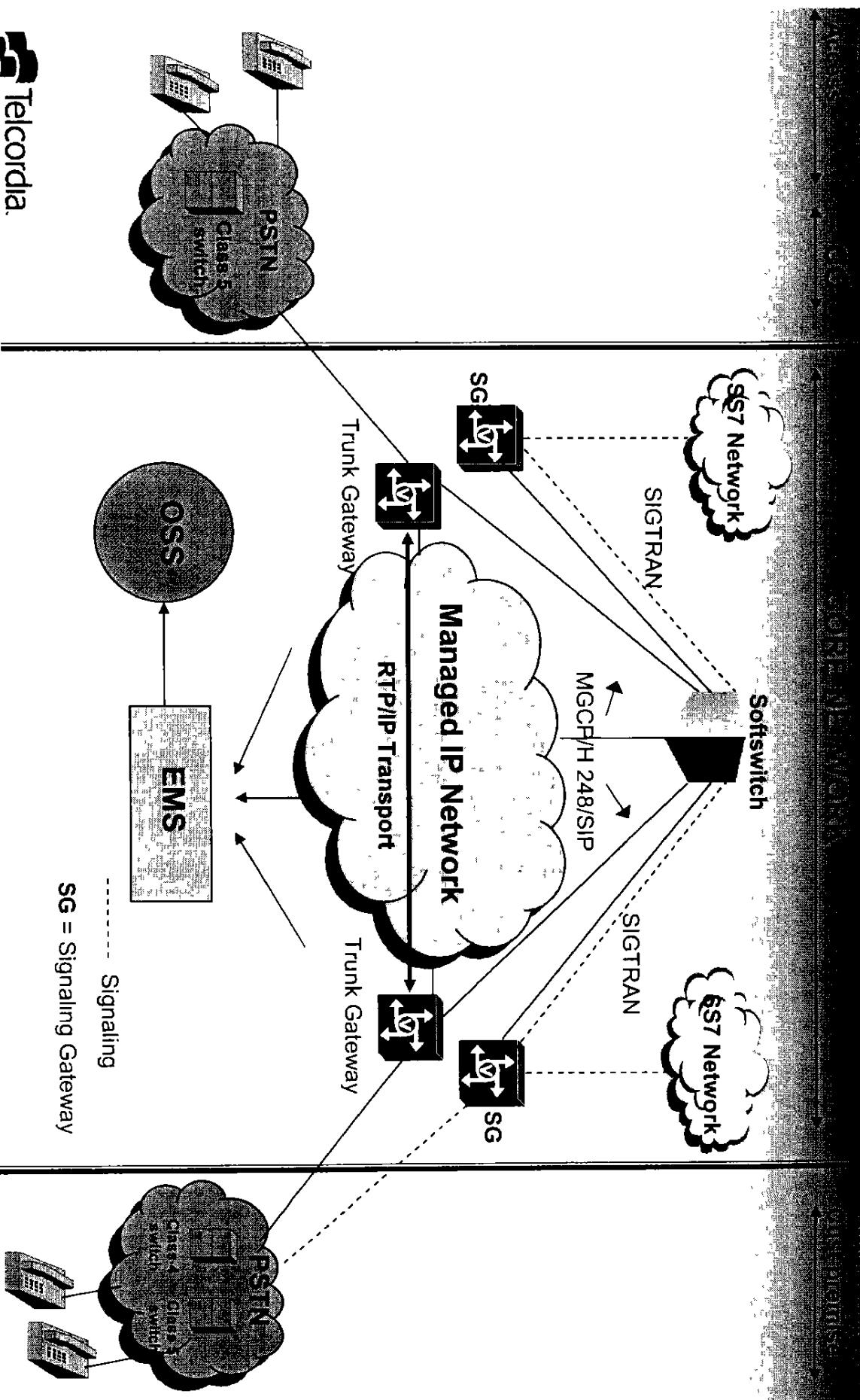
- **VoIP Architecture Components**

- **Access Transport Medium** (DSL, Cable, LAN, WI-FI, Satellite)
- **Voice Terminal** (POTS phone, cell/smart phone, PDA, IP phone, PC+USB phone, PC, WI-FI phone)
- **Network Protocols** (ITU H.323, H.248, BICC, IETF SIP, MGCP, SIGTRAN, IEEE 802.11e, 3GPP 3G-324M, Cable Lab NCS)
- **Network Systems** (Soft Switch; Gatekeeper; Gateway -Trunk, Signaling, CAS, PRI, Analog, GSM; Residential Gateway-IAD, MTA, Loop Start; SIP Server; Service Server - Feature, Conference, Packet Voice Mail, Media, Announcement, Wiretap, IVR Server)

Class 4 Internet Telephony Gateway VoIP Architecture

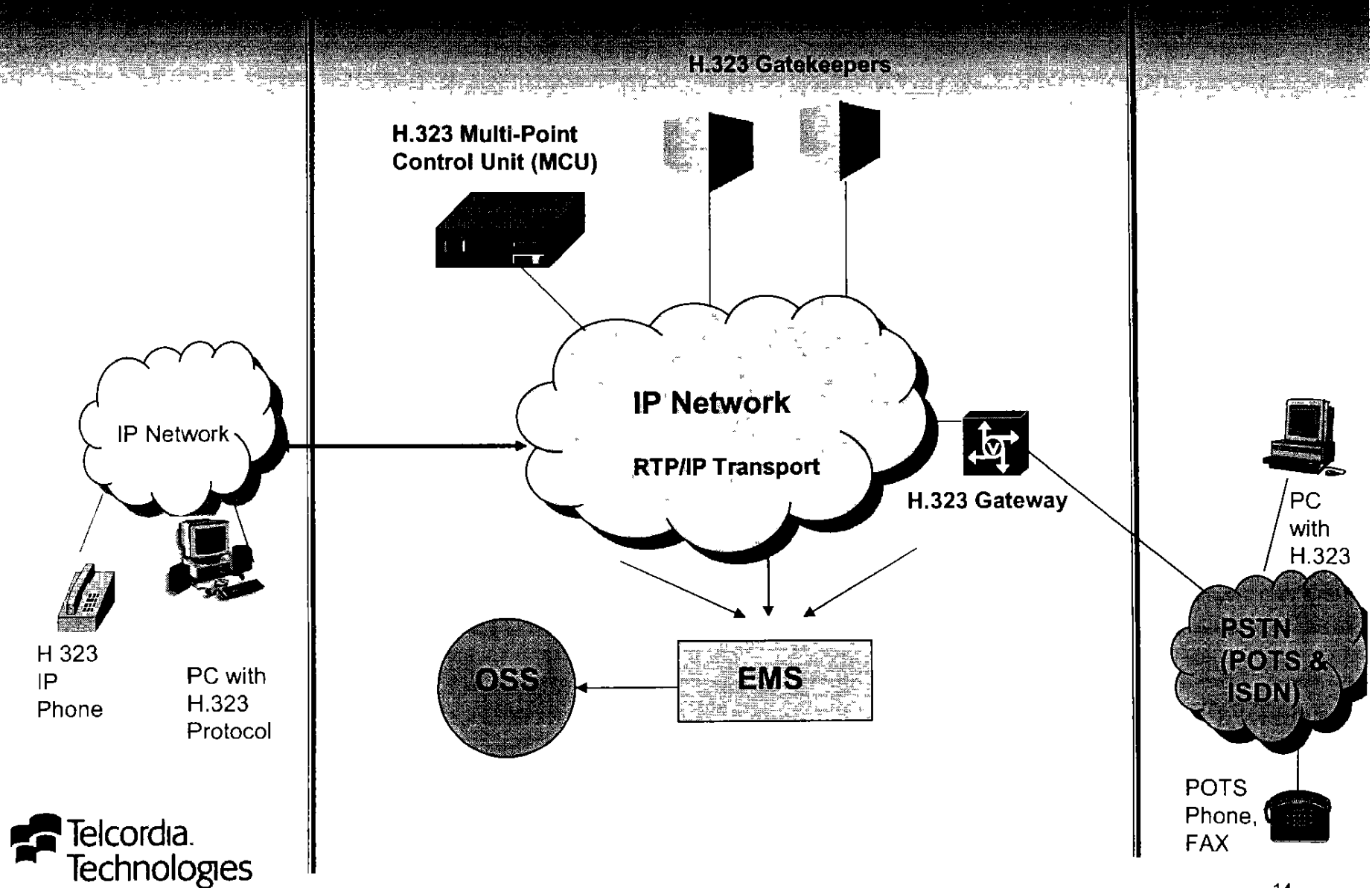


Class 4 Packet Tandem VoIP Architecture

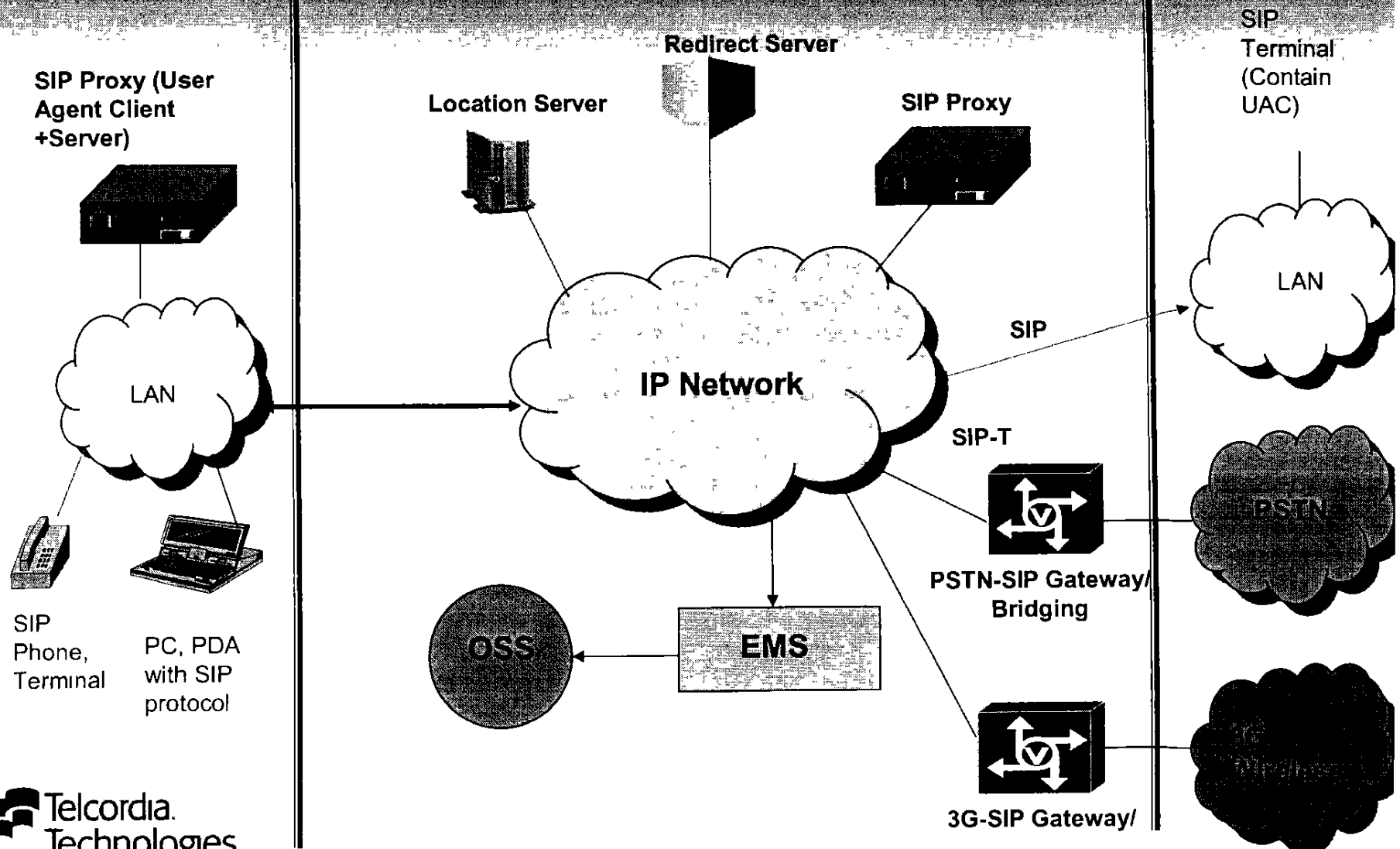


----- Signaling
SG = Signaling Gateway

H.323 Gateway/Gatekeeper VoIP Architecture

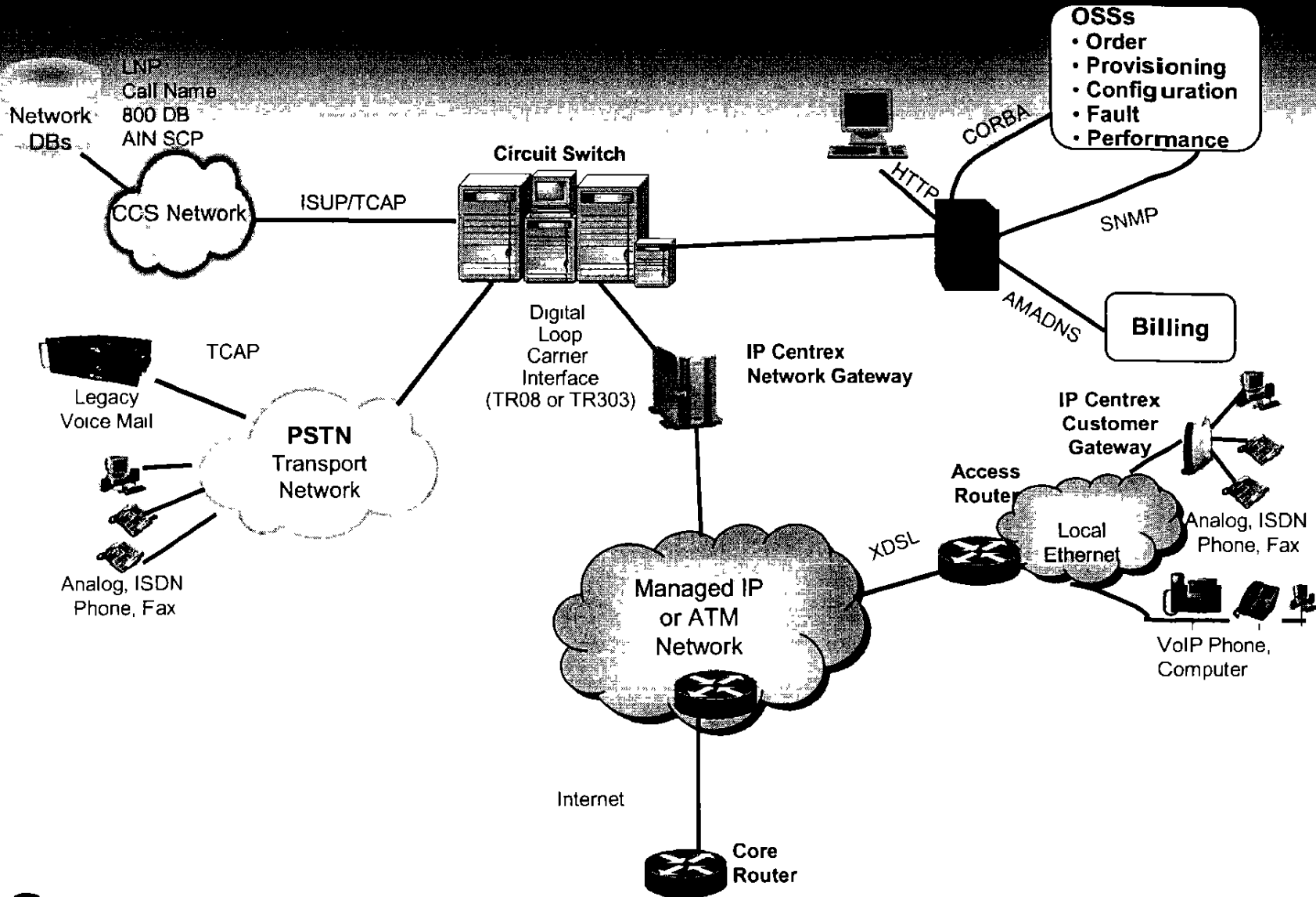


SIP VoIP Architecture

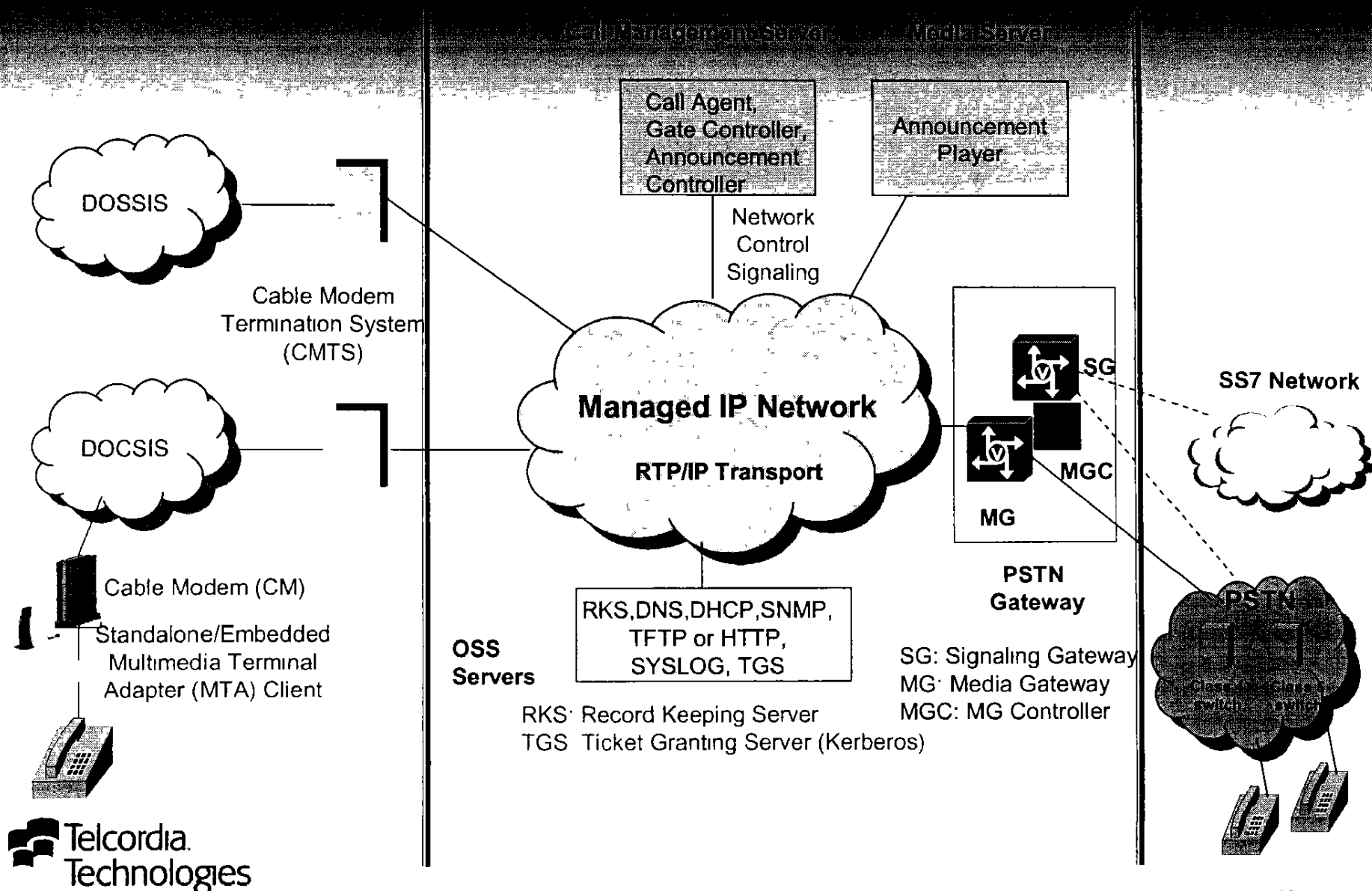


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IP Centrex with Circuit Switch VoIP Architecture



Packet Cable VoIP Architecture

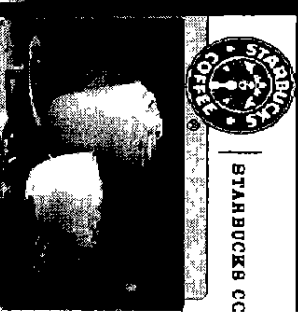
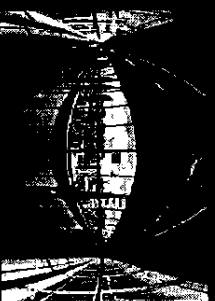
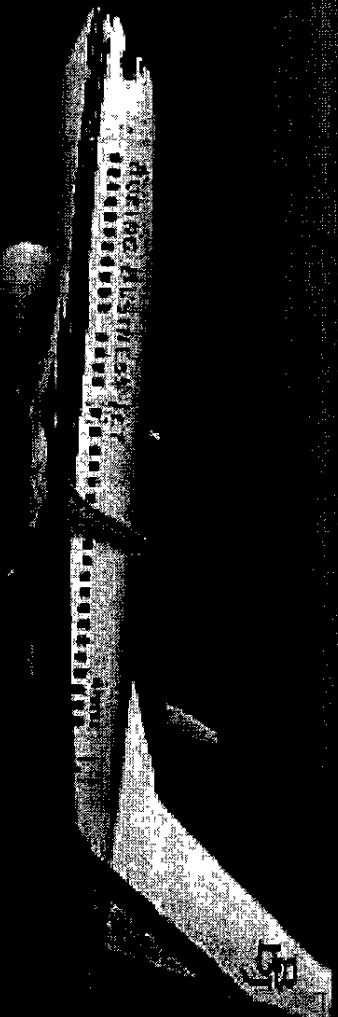


State of VoIP Technology Adoption

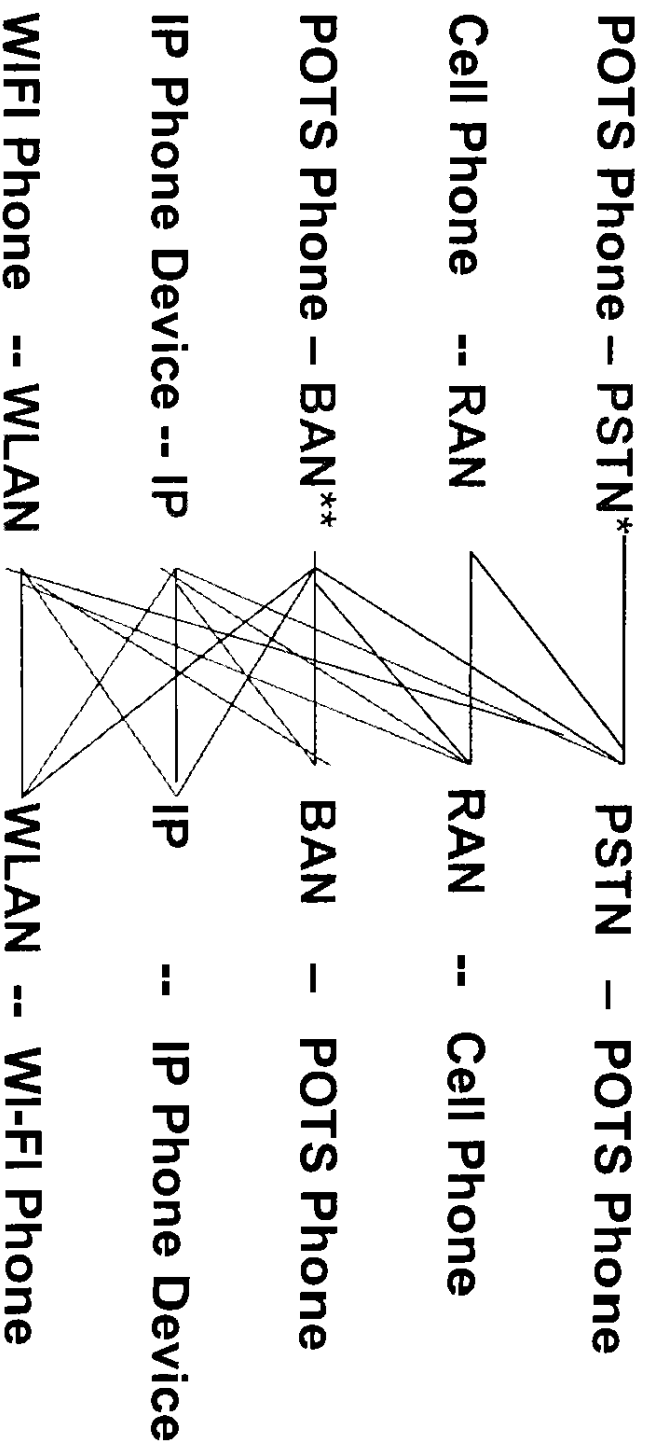
Internet Telephony Service Providers

- **LEC/IXC (Class 4 and 5 Soft Switches, Gateway, IP Centrex – H.323, MGCP, Megaco, SIP)**
- **Cable Carriers (Packet Cable)**
- **Satellite Carriers (H.323, SIP)**
- **Wireless Carriers (mainly in IP trunking, 3G-324M, SIP later)**
- **Hot Spot Providers (early stage, SIP)**
- **Internet Service Providers (early stage, SIP based)**
- **Application Service Providers (IP Contact Center, H.323, SIP)**
- **Broadband CLECs (early stage)**
- **Enterprise Companies (H.323 mainly)**
- **System Integrator/Outsourcing Firms (IP Centrex/PBX)**

Voice over WI-FI over IP Pipes



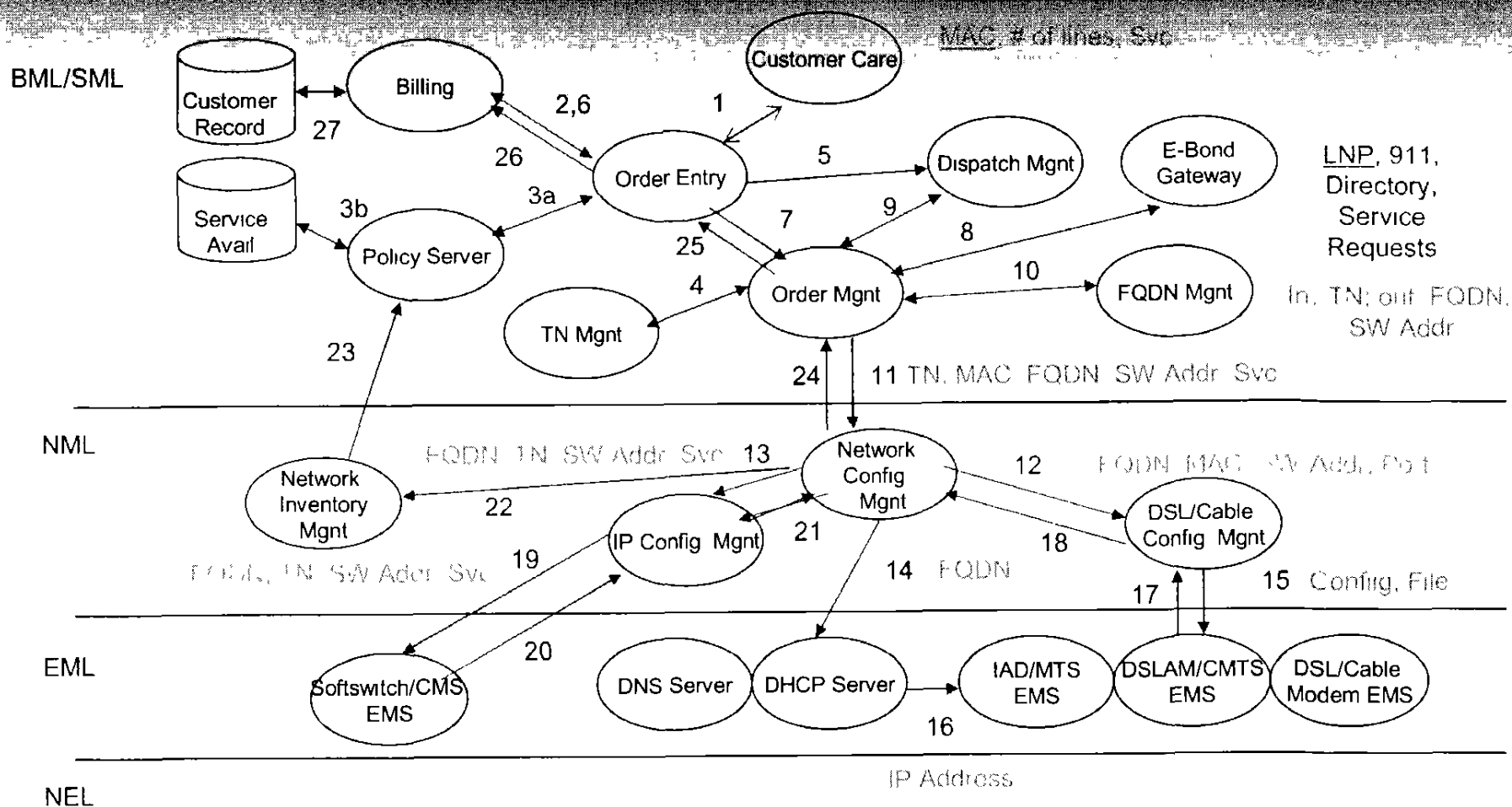
VoIP End Point Connection Types



* Include ISDN

** Include DSL and Cable

VoIP Initial Provisioning Process Example – No Service Server for VoDSL and Packet Cable in Class 5 Soft Switch Architecture



Key Differences VoIP Ordering and Provisioning From Circuit Switched Voice Services

- **Provisioning and Ordering for Various VoIP Architecture and Components**
- **Varieties of IP Transport Network Infrastructure and QoS** (e.g. MPLS, IP with DiffServ, ATM, DWDM,)
- **Provisioning Mechanisms for Diversity of CPE** (e.g. IAD, MTA, Residential Gateway, IP Phone -- subscribe/notify scheme*)
- **Interaction of Existing LAN Devices with VoIP CPE**
- **Multiple VoIP Protocols**
- **Assignment of FQDN Besides Phone Numbers**
- **Use of DNS/DHCP Servers for Static and Dynamic IP Address**
- **New/Change/Cancel Orders (Port Numbers, Features)**
- **Customer Self Provisioning and Personal Call Control for Ports and Features from PC/PDA/Phones**

* Notify using SNMP, SIP/Notify while Subscribe using TFTP, HTTP

